

CLAIMS

What is claimed is:

1. A joint assembly comprising:
at least one ceramic matrix composite conduit;
at least one metal conduit; and
an insert disposed inside the ceramic composite conduit and the metal
conduit,
wherein the ceramic composite conduit is joined to the metal conduit using the
insert.

2. The joint assembly of Claim 1, wherein the insert is bonded to the
ceramic matrix composite conduit.

3. The joint assembly of Claim 1, wherein the metal conduit is brazed to
the insert.

4. The joint assembly of Claim 1, wherein the ceramic matrix composite
conduit is reinforced with carbon fibers.

5. The joint assembly of Claim 1, wherein the ceramic matrix composite
conduit, the insert, and the metal conduit comprise a circular cross-section.

6. The joint assembly of Claim 1, wherein the ceramic matrix composite
conduit comprises a silicon carbide matrix.

7. The joint assembly of Claim 1, wherein the insert is a monolithic
ceramic having a coefficient of thermal expansion approximately equal to or less than
the ceramic matrix composite conduit.

8. The joint assembly of Claim 1, wherein the insert is silicon nitride.
9. The joint assembly of Claim 1 further comprising a plurality of inserts that join a plurality of ceramic matrix composite conduits to a plurality of metal conduits.

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10. A joint assembly for use in a rocket nozzle comprising:

at least one ceramic matrix composite rocket nozzle comprising carbon fibers in a ceramic matrix;

at least one metal manifold; and

a silicon nitride insert disposed inside the ceramic matrix composite rocket nozzle and the metal manifold,

wherein the ceramic matrix composite rocket nozzle is joined to the metal manifold using the silicon nitride insert.

11. The joint assembly of Claim 10, wherein the silicon nitride insert is bonded to the ceramic matrix composite rocket nozzle.

12. The joint assembly of Claim 10, wherein the metal manifold is brazed to the silicon nitride insert.

13. The joint assembly of Claim 10, wherein the ceramic matrix composite rocket nozzle comprises a silicon carbide matrix.

14. The joint assembly of Claim 10, wherein the ceramic matrix composite rocket nozzle, the silicon nitride insert, and the metal manifold comprise a circular cross-section.

15. The joint assembly of Claim 10 further comprising a plurality of silicon nitride inserts that join a plurality of ceramic matrix composite rocket nozzles to a plurality of metal manifolds.

PROTECTIVE EMBODIMENT

16. A process for joining a ceramic matrix composite conduit to a metal conduit comprising the steps of:

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- (a) securing an insert inside at least one fiber preform of the ceramic matrix composite conduit;
- (b) co-processing the insert with the fiber preform;
- (c) placing a metal conduit over the insert; and
- (d) securing the metal conduit to the insert.

17. The process of Claim 16, wherein the step of co-processing comprises infiltrating a ceramic matrix precursor slurry into the fiber preform and the insert and heat treating, thereby forming the ceramic matrix composite conduit and bonding the insert to an inside of the ceramic matrix composite conduit.

18. The process of Claim 16, wherein the metal conduit is secured to the insert using brazing.

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19. A method of joining a ceramic matrix composite rocket nozzle to a metal manifold comprising the steps of:

(a) securing a silicon nitride insert inside a fiber preform of the ceramic matrix composite rocket nozzle;

(b) co-processing the silicon nitride insert with the fiber preform;

(c) placing a metal manifold over the silicon nitride insert; and

(d) brazing the metal manifold to the silicon nitride insert.

20. The method of Claim 19 wherein the step of co-processing comprises

infiltrating a ceramic matrix precursor slurry into the fiber preform and the silicon nitride insert and heat treating, thereby forming the ceramic matrix composite rocket nozzle and bonding the silicon nitride insert to an inside of the ceramic matrix composite rocket nozzle.